AMENDMENT/RESPONSE

This is in response to the attached Office Action dated February 27, 2007. See attached Office Action.

In the Office Action:

The Examiner stated:

> "Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pietzka et al. The reference teaches, especially in columns 2, 4, and 6, heating petroleum residue, devolatilizing, and coking. The temperature and pressure overlaps the claimed ranges. The reference does not teach the time of treatment, this is deemed an obvious expedient to achieve the desired degree of carbonization/coking; In re Boesch 205 USPQ 215.
>
> Figure 2 depicts removing material from the bottom. Concerning claim 3, the back blades clean after the front blades push. In any event, having a system to remove the product is an obvious expedient for complete product recovery. Claim 4 does not require anything.
>
> It is noted that claim 1a should actually require heating; delete 'providing...for'. Claim 1g is met in that the product must cool at some point, such as during packaging prior to shipment. Claim 5 is obvious as an inexpensive way to perform cooling; note the coke is exposed to air in fig. 2. Claim 6 is an obvious expedient to permit easy pumping of the product for processing."

Background

The problem our invention solves is that operators want coke to form but only where they want it to form (for example, not in the tubular heater). Unfortunately, coke wants to form when it gets hot. (for example, in the tubular heater). So in the heating of the stock, coke begins to form and it tends to foul and eventually plug tubular heaters. This problem faces all coke plants but is mitigated somewhat by forcing the stock through the heaters at extremely high velocities but with the accompanying high pressure drop. Then, in the delayed coking process, the heated stock is sent to large drums where, over time, the coke forms into a solid mass. The coking is now finished. But now they must go through a decoking process to get the coke out of the drums. The decoking is done by opening the drums thereby exposing the coke to the atmosphere then

hydroblasting which creates a mess of wet coke on the ground and generates atmospheric emissions.

The invention utilizes a flash vessel and horizontal reactor agitation system in combination to prevent the buildup of coke and eliminate traditional decoking operations which are environmentally harmful. Within the horizontal reactor vessel, the mixing and kneading of the viscous hydrocarbons is critical and occurs to promote devolatilization by pulling apart the tacky mass thus allowing trapped volatile materials to be released and recovered. The remaining coke precursers now have less volatile material that serves as diluent, therefore the carbonization reaction is promoted and coke is more rapidly formed.

Our Response

Regarding Claim 1, the Examiner stated:

> "The reference teaches, especially in columns 2, 4, and 6, heating petroleum residue, devolatilizing, and coking. The temperature and pressure overlaps the claimed ranges. The reference does not teach the time of treatment, this is deemed an obvious expedient to achieve the desired degree of carbonization/coking; In re Boesch 205 USPQ 215."... "It is noted that claim 1a should actually require heating; delete 'providing...for'. Claim 1g is met in that the product must cool at some point, such as during packaging prior to shipment."

Our claimed process for the continuous production of coke stated:

There is claimed:

1. A process for the continuous production of coke, which comprises:
(a) providing a means for heating petroleum residuum to a temperature within the range from about 850 – 1000 degree F., (b) transferring the resulting heated petroleum residuum to a vessel, (c) releasing of vapors within said vessel, (d) wherein the residence time of the remaining petroleum residuum is less than 5 minutes within said vessel, transferring the remaining petroleum residuum from near the bottom of said vessel to a reactor vessel, (e) operating said reactor vessel under pressure ranging from about 4 psia to 65 psia, (f) mixing and kneading within said reactor vessel to promote devolatilization, carbonization and formation of coke, (g) providing a means for cooling the resulting coke product to a range from about 100 – 250 degrees F and (h) transporting the resulting coke.

Before obviousness may be established, the Examiner must show that there is either a suggestion in the art to produce the claimed invention or a compelling motivation based on sound scientific principles. Logic compels that the suggestion or motivation be accompanied by a general knowledge of the art-recognized techniques for carrying out the proposed invention. *Ex Parte Kranz,* 19 U.S.P.Q. 2d 1216, 1218 (B.P.A.I. 1990).

We believe the reference does not teach Claim 1d, nor Claim 1f nor does it show that there is either a suggestion in the art to produce the claimed invention or a compelling motivation based on sound scientific principles. Our Claim 1d states "wherein the residence time of the remaining petroleum residuum is less than 5 minutes within said vessel, transferring the remaining petroleum residuum from near the bottom of said vessel to a reactor vessel". We believe the time of treatment is not "an obvious expedient to achieve the desired degree of carbonization /coking." As stated in the specification (paragraph 59) "this process allows for flashing a significant amount of the vapors in the flash vessel prior to the reactor and allowing only minimal residence time in the flash vessel which inhibits solidification of the coke and the difficulty of removal of the coke from flash drums." The difficulty of removal of the coke from flash drums is an inherent problem of existing coke plants which use the delayed coking process. Pietska does not suggest providing a minimum residence time (no more than 5 minutes), and then moving to a reactor nor does Pietska provide a compelling motivation for preventing the buildup of coke and eliminate traditional decoking operations.

We strongly note the difference between Pietska and the claimed invention Claim 1f "mixing and kneading within said reactor vessel to promote devolatilization, carbonization and formation of coke." The Examiner does not show that there is either a suggestion in the art to produce the claimed invention or a compelling motivation based on sound scientific principles. The reference makes no mention of such a reactor vessel with mixing and kneading to enable/promote devolatization and carbonization for continuous coke formation. Pietzka states in Column 2 Lines 17 – 49 the process of the reference and there is neither a suggestion to utilize a reactor vessel for mixing and kneading nor compelling motivation for preventing the buildup of coke.

Our specification states "This process uses an efficient mixing and kneading system thereby providing uniform heat and mass transfer through the heated mixture thereby enhancing VCM reduction and reducing shot-coke production." Shot coke is an inferior grade of coke.

Screw 34 of Pietzka column 8 does not act as an agitator shaft to mix or knead. The reference admits in Column 8 Line 8 "The heated secondary coking zone 28 ...contains, as a "**transport**" means, a screw 34 which uniformly delivers the green coke..."

In regards to the invention's agitator shaft,"the agitation system design is important in the efficient coking of highly viscous petroleum products. The agitation system is selected to produce an intensive mixing / kneading effect and be self-cleaning. A suitable agitation system may include continuously operating single shaft agitator or multi-parallel agitators, intermeshing as they rotate inside horizontal figure of eight housing. The agitator shafts should be equipped with radial extensions so that they totally clean each other's discs and bars, for efficient self- cleaning and continuously scraping the viscous residuum and coke from the reactor surfaces." Mixing and kneading is a pure mechanical process and it greatly enhances the release of volatiles trapped in the viscous mass.

See revised attached specification highlighting new Figure 2 showing the agitation system in the reactor vessel that promote devolatilization, carbonization and formation of coke.

Look at the Invention as a whole - including the problem solved

In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex , Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983). The invention as a whole embraces the structure, its properties and the problem it solves. The particular problem facing the inventor must be considered in determining obviousness of its creation. Thus, the question is whether what the inventor did would have been obvious to one of ordinary skill in the art attempting to solve the problem upon which the inventor was working. The problem solved by the invention is always relevant. *In re Wright* 848 F.2d 1216, 6 U.S. P.Q. 1959, 1961, 1962 (Fed. Cir. 1988).
As stated in the specification "The invention utilizes a flash vessel and reactor agitation system in combination to prevent the buildup of coke and eliminate traditional decoking operations. Within the reactor vessel, the mixing and kneading of the hydrocarbons is critical and occurs to promote devolatilization, carbonization and forming of coke."

Pietzka suggests that there are two heating steps in series One is a pre-heating step and the second is a coking step. This provides for more opportunities to foul because heating heavy residues causes the produced coke to deposit on metal surfaces. Also, Pietzka has a plurality of tubes that will be difficult to unclog.

We believe the reference does not teach steps (d), and (f) of Claim 1 nor does it show that there is either a suggestion in the art to produce the claimed invention or a compelling motivation based on sound scientific principles.

To summarize, Pietzka makes no mention of mixing and kneading in a reactor vessel to promote devolatilization, carbonization and forming of coke.

Addressing Examiner Notes

The Examiner noted that "claim 1a should actually require heating; delete 'providing...for'. We have made the change in the attached revised Claim 1.

In addition, our specification states "A suitable agitation system may include continuously operating single shaft agitator or multi-parallel agitators, intermeshing as they rotate inside horizontal figure of eight housing." We have modified our claims to include reference to the horizontal nature of the vessel.

Regarding Claim 2, the Examiner makes no mention of the specifics of mixing and kneading step nor any suggestion that the mixing kneading in a reactor vessel will prevent plugging. Our Claim 2 states , "The process of claim 1 wherein the mixing and kneading step occurs by using a reactor vessel with a single agitation shaft and with an inlet for the remaining petroleum residuum and an outlet for the resulting coke product, and multi-vapor outlets." This expands upon Claim 1f emphasizing a mechanical process for mixing and kneading.

Regarding Claim 3, the Examiner stated "Concerning Claim 3, the back blades clean after the front blades push. In any event, having a system to remove the product is an obvious expedient for complete product recovery." Our Modified Claim 3, " The process of claim 1 wherein the mixing and kneading step occurs by using a horizontal reactor vessel with multiple agitation shafts~~, including a main agitator shaft and a cleaning agitator shaft,~~ equipped with radial extensions, discs and bars -so that the shafts continuously scrape the resulting coke from the reactor surfaces~~as well as from each of the agitation shafts~~." The mixing and kneading Claim 1f occurs by using a reactor vessel with multiple agitation shafts. These shafts with radial extensions have multiple purposes beyond "removing the product". The shafts mix and knead to enable/promote devolatilization and carbonization of rapid coke formation. Also, using a reactor vessel with multiple agitation shafts with radial extensions which continuously scrape the resulting coke from the reactor as well as from each of the agitation shafts solves the problem of "the buildup of coke" by continuously cleaning the reactor surfaces.